

APPENDIX A

The McGill Physiology Virtual Lab

Respiration Laboratory

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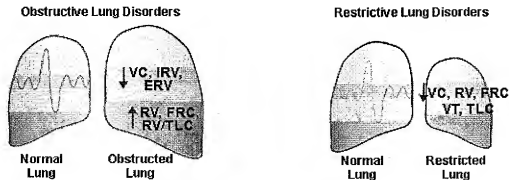
THEORY> Lung Diseases

In a **restrictive lung disease**, the **compliance of the lung is reduced**, which increases the stiffness of the lung and limits expansion. In these cases, a greater pressure (ΔP) than normal is required to give the same increase in volume (ΔV). Common causes of decreased lung compliance are pulmonary fibrosis, pneumonia and pulmonary edema.

In an **obstructive lung disease**, airway obstruction causes an **increase in resistance**. During normal breathing, the pressure volume relationship is no different from in a normal lung. However, when breathing rapidly, greater pressure is needed to overcome the resistance to flow, and the volume of each breath gets smaller. Common obstructive diseases include asthma, bronchitis, and emphysema.

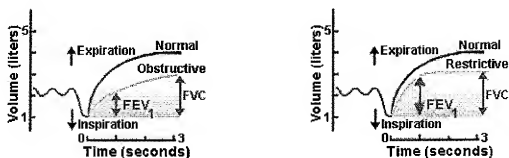
Changes in Lung Volumes

Observe the changes in lung volumes from normal for restrictive and obstructive lung disorders. In the obstructed lung, respiration ends prematurely, thus increasing RV and FRC. In the restricted lung, volumes are small because inspiration is limited due to reduced compliance.



The FVC test allows one to clearly distinguish between the two disease types. Notice in the obstructed lung (below left), how FVC is smaller than normal, but also that FEV₁ is **much** smaller than normal. This is because it is very difficult for a person with an obstructive disease (eg. asthma) to exhale quickly due to the increase in airway resistance. As a result, the FEV₁/FVC ratio will be much lower than normal, for example 40% as opposed to 80%.

In the restricted lung, the FVC is again smaller than normal, but the FEV₁ is relatively large in comparison. i.e. the FEV₁/FVC ratio can be higher than normal, for example 90% as opposed to 80%. This is because it is easy for a person with a restricted lung (eg fibrosis) to breathe out quickly, because of the **high elastic recoil of the stiff lungs**.



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